

SECTION 5.2

WINERIES-AGING

(Updated February 1992)

EMISSION INVENTORY SOURCE CATEGORY

Industrial and Other Processes

EMISSION INVENTORY CODES (CES) AND DESCRIPTIONS

420-410-6090-0000 (60467) Wine Aging

METHODS AND SOURCES

This category is an inventory of the ethanol emissions from the aging of brandy in 50-gallon oak barrels.

Brandy is produced via a distillation process which separates and concentrates ethanol and other volatile substances from wine or fermented juices. The brandy is then aged for a period of two to ten years. During the aging process, there is considerable ethanol loss which is attributed to absorption of alcohol by the wood of the barrels. The alcohol is eventually released from the wood into the atmosphere. In a letter to the Fresno County Air Pollution Control District ¹ from Hugh Cook of the Wine Institute an emission factor of 0.0136 pounds per day per 50-gallon barrel was obtained. This emission factor was derived by assuming that brandy is 120 proof on the average, and there is an alcohol loss of 2.5% per year per barrel (see sample calculations).

Brandy inventories in California for 1992 are reported by the Wine Institute ² to be 44,487,000 gallons in storage. This statewide total was distributed to the counties based on the amount of grapes crushed and produced in each county. The California Department of Food and Agriculture (CDFA) annually reports the amount of grapes crushed in each of the 17 grape growing districts in the State ³ (Table I). The amount of grapes crushed in each county (Table II) was estimated by disaggregating the district total according to the proportion of the grapes produced in the county to the district. The grape production in each county was taken from the Annual Crop and Livestock Report ⁴ prepared by each Agricultural Commissioner's office. The amount of grapes produced and/or crushed in counties that belong to more than one grape growing district, e.g., Sacramento County, was determined with the aid of CDFA's map (Figure 1) delineating the grape growing districts.

The statewide ethanol emissions for 1990 from brandy production by county are presented in Table III.

ASSUMPTIONS

1. Brandy is 120 proof (60% alcohol) on the average.
2. Alcohol is lost during aging at a rate of 2.5% per year per barrel.
3. The amount of brandy in storage for each county is proportional to the amount of grapes crushed and can be used to apportion the statewide brandy storage to the counties.
4. The amount of grapes crushed is proportional to the amount of grapes produced and can be used to apportion the grapes crushed in a district to the counties.

COMMENTS AND RECOMMENDATION

Two other sources of ethanol emissions in the production of brandy may be significant; the distillation process and the bottling process. These sources of emissions have not been inventoried due to lack of information.

CHANGES IN METHODOLOGY

There have been no changes in the methodology since the 1979 inventory.

DIFFERENCES BETWEEN 1987 AND 1979 EMISSION ESTIMATES

The 1990 emission estimates are slightly lower than the 1987 estimates because of an error found in the 1987 emission estimates. The process rates for 1990 are lower than 1987 because there is less demand for Brandy.

TEMPORAL ACTIVITY

Brandy is aged for a period of two to ten years. During this period emissions are released into the atmosphere 365 days per year and 24 hours per day.

SAMPLE CALCULATIONS

1. Estimate the amount of brandy stored in Alameda County in 1990.

- A) First, estimate the amount of grapes crushed in Alameda. Alameda is one of the six counties that comprise District 6 with 8978.4 tons of grapes crushed in 1990. Calculate Alameda's share of the district's total amount of grapes crushed based on the amount of grapes produced.

$$\frac{4629 \text{ tons grapes produced in ALA}}{9680 \text{ tons grapes produced in District 6}} \times 8978.4 \text{ tons grapes crushed in District 6}$$

$$= 4293.49 \text{ tons grapes crushed in Alameda}$$

- B) Estimate the amount of brandy stored in Alameda County.

$$\frac{4293.49 \text{ tons grapes crushed in ALA}}{2,576,005 \text{ tons grapes crushed in CA}} \times 44,487,000 \text{ gal of brandy stored in CA}$$

$$= 74,147.56 \text{ gallons} / 50 = 1483 \text{ barrels (based on 50 gallons per barrel)}$$

2. Determination of the Wine Institute's Emission Factor:

$$\text{Specific gravity of ETOH at } 60^{\circ}\text{F} \times \frac{8.388 \text{ lbs}}{\text{gal}} \times \frac{2.5\% \text{ ETHOH lost}}{\text{year}} \times \frac{50 \text{ gal}}{\text{barrel}} \times 60\% \text{ ETHOH at 120 proof}$$

$$= .79384 \times 8.338 \times .025 \times 50 \times .60 = 4.96 \text{ lbs/barrel-year}$$

3. Emissions from Storage of Brandy in Alameda County:

$$= \text{amount of brandy in storage} \times \text{emission factor}$$

$$= 1483 \text{ barrels} \times 4.96 \text{ lbs/barrel-year} / 2,000 \text{ lbs/ton}$$

$$= 3.68 \text{ tons/yr ethanol emissions in Alameda County}$$

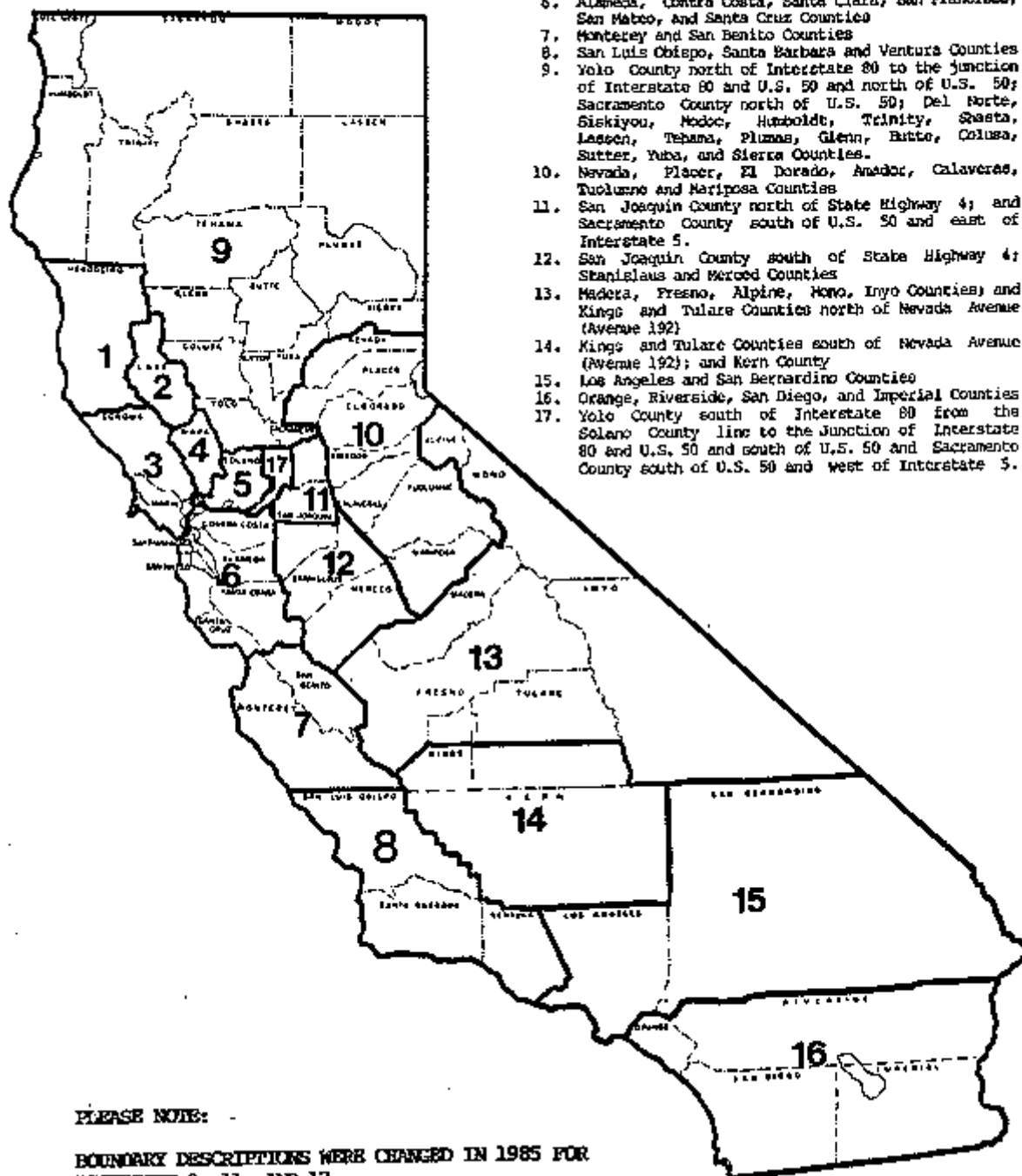
REFERENCES

1. Letter from Hugh Cook of the Wine Institute to Robert Bashian of the Fresno County APCD (Jan. 13, 1978).
2. Personal Communication, Wade Stevenson, Wine Institute, (415) 512-0151 (February 1992).
3. California Department of Food and Agriculture, Final Grape Crush Report 1990 Crop, (March 11, 1991).
4. County Agricultural Commissioner's Office, 1990 Agricultural Crop and Livestock Report, California (1991).

UPDATED BY

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MAP & DEFINITIONS OF CALIFORNIA GRAPE PRICING DISTRICTS



PLEASE NOTE:

BOUNDARY DESCRIPTIONS WERE CHANGED IN 1985 FOR
DISTRICTS 9, 11, AND 17.

TABLE I
1990 AMOUNT OF GRAPES CRUSHED IN CALIFORNIA BY DISTRICT ^a

| <u>DISTRICT</u> ^b | <u>GRAPES CRUSHED (TONS/YR)</u> |
|------------------------------|---------------------------------|
| 1 | 39,778.9 |
| 2 | 7,710.7 |
| 3 | 111,930.1 |
| 4 | 114,303.7 |
| 5 | 6,094.2 |
| 6 | 8,978.4 |
| 7 | 105,080.0 |
| 8 | 61,546.9 |
| 9 | 17,880.8 |
| 10 | 8,694.4 |
| 11 | 286,441.7 |
| 12 | 325,379.3 |
| 13 | 1,007,494.3 |
| 14 | 448,029.1 |
| 15 | 2,633.0 |
| 16 | 9,309.2 |
| 17 | 14,720.2 |
| STATE TOTAL | 2,576,005.0 |

a. Abstracted from Reference 3.

b. Grape growing districts are shown in Figure 1, Reference 3.

Table II

1990 Grapes Crushed (Tons) in California by Counties

| County Name | Air Basin | Grapes Crushed |
|-----------------|-----------|----------------|
| ALAMEDA | SF | 4293.49 |
| ALPINE | GBF | 0 |
| AMADOR | MC | 5155.79 |
| BUTTE | SV | 0 |
| CALAVERAS | MC | 328.94 |
| COLUSA | SV | 0 |
| CONTRA COSTA | SF | 1975.62 |
| DEL NORTE | NC | 0 |
| EL DORADO | SV | 2416.63 |
| EL DORADO | LT | 0 |
| FRESNO | SJV | 675783.97 |
| GLENN | SV | 0 |
| HUMBOLDT | NC | 0 |
| IMPERIAL | SED | 0 |
| INYO | GBV | 0 |
| KERN | SED | 0 |
| KERN | SJV | 305423.06 |
| KINGS | SJV | 16358.86 |
| LAKE | LC | 7991.00 |
| LASSEN | NEP | 0 |
| LOS ANGELES | SC | 0 |
| LOS ANGELES | SED | 0 |
| MADERA | SJV | 242734.07 |
| MARIN | SF | 0 |
| MARIPOSA | MC | 85.88 |
| MENDOCINO | NC | 39778.80 |
| MERCED | SJV | 90453.69 |
| MODOC | NEP | 0 |
| MONO | GBV | 0 |
| MONTEREY | NCC | 98606.44 |
| NAPA | SF | 114303.70 |
| NEVADA | MC | 481.50 |
| ORANGE | SC | 0 |
| PLACER | LT | 0 |
| PLACER | MC | 0 |
| PLACER | SV | 225.57 |
| PLUMAS | MC | 0 |
| RIVERSIDE | SED | 0 |
| RIVERSIDE | SC | 9272.43 |
| SACRAMENTO | SV | 57954.27 |
| SAN BENITO | NCC | 6473.53 |
| SAN BERNARDINO | SC | 2633.00 |
| SAN BERNARDINO | SED | 0 |
| SAN DIEGO | SD | 36.77 |
| SAN FRANCISCO | SF | 0 |
| SAN JOAQUIN | SJV | 379637.58 |
| SAN LUIS OBISPO | SCC | 33179.62 |
| SAN MATEO | SF | 0 |
| SANTA BARBARA | SCC | 28367.28 |
| SANTA CLARA | SF | 3594.14 |
| SANTA CRUZ | NCC | 222.60 |
| SHASTA | SV | 0 |
| SIERRA | MC | 0 |
| SISKIYOU | NEP | 0 |
| SOLANO | SF | 6094.30 |
| SOLANO | SV | 0 |
| SONOMA | NC | 55965.05 |
| SONOMA | SF | 55965.05 |
| STANISLAUS | SJV | 114505.25 |
| SUTTER | SV | 0 |
| TEHAMA | SV | 0 |
| TRINITY | NC | 0 |
| TULARE | SJV | 219145.76 |
| TUOLUMNE | MC | 0 |
| VENTURA | SCC | 0 |
| YOLO | SV | 29436.68 |
| YUBA | SV | 0 |
| TOTAL | | 2,608,880.44 |

Table III
1990 Area Source Emissions
Activity: Wines & Brandy
Process: Food & Agricultural
Entrainment: Process Loss
Dimn: Aging Wine
CES: 60467

Process Rate Unit: BBL-Year of Stored Brandy

| AB | County | Process Rate | TOG Emis. (Tons / Year) | CO Emis. (Tons / Year) | NOX Emis. (Tons / Year) | SOX Emis. (Tons / Year) | PM Emis. (Tons / Year) |
|-------|-----------------|--------------|----------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| LC | LAKE | 2760 | 6.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| MC | AMADOR | 1781 | 4.42 | 0.00 | 0.00 | 0.00 | 0.00 |
| | CALAVERAS | 114 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| | MARIPOSA | 30 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 |
| NC | MENDOCINO | 13739 | 34.07 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SONOMA | 19330 | 47.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| NCC | MONTEREY | 34058 | 84.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SAN BENITO | 2236 | 5.55 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SANTA CRUZ | 77 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 |
| SC | RIVERSIDE | 3203 | 7.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SAN BERNARDINO | 909 | 2.26 | 0.00 | 0.00 | 0.00 | 0.00 |
| SCC | SAN LUIS OBISPO | 11460 | 28.42 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SANTA BARBARA | 9798 | 24.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| SD | SAN DIEGO | 13 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| SF | ALAMEDA | 1483 | 3.68 | 0.00 | 0.00 | 0.00 | 0.00 |
| | CONTRA COSTA | 682 | 1.69 | 0.00 | 0.00 | 0.00 | 0.00 |
| | NAPA | 39480 | 97.91 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SANTA CLARA | 1241 | 3.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SOLANO | 2105 | 5.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SONOMA | 19330 | 47.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| SJV | FRESNO | 233413 | 578.86 | 0.00 | 0.00 | 0.00 | 0.00 |
| | KERN | 105492 | 261.62 | 0.00 | 0.00 | 0.00 | 0.00 |
| | KINGS | 5650 | 14.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | MADERA | 83839 | 207.92 | 0.00 | 0.00 | 0.00 | 0.00 |
| | MERCED | 31242 | 77.48 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SAN JOAQUIN | 131126 | 325.19 | 0.00 | 0.00 | 0.00 | 0.00 |
| | STANISLAUS | 39550 | 98.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| | TULARE | 31092 | 187.72 | 0.00 | 0.00 | 0.00 | 0.00 |
| SV | EL DORADO | 835 | 2.07 | 0.00 | 0.00 | 0.00 | 0.00 |
| | NEVADA | 166 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 |
| | PLACER | 78 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SACRAMENTO | 20017 | 49.64 | 0.00 | 0.00 | 0.00 | 0.00 |
| | SOLANO | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | YOLO | 10167 | 25.21 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTAL | | 856496 | 2234.69 | 0.00 | 0.00 | 0.00 | 0.00 |

Fraction of Reactive Organic Gases (FROG): 1.0000

(Reactive Organic Gases (ROG) Emissions = TOG X FROG)

Fraction of PM10 (FRPM10): .7000

(PM10 Emissions = PM X FRPM10)